What is claimed is:

1. A nanosensor, comprising:

a semiconductor element integral to an insulating substrate, and having length and width dimensions parallel to the insulating substrate, and a depth dimension orthogonal to the insulating substrate, the depth dimension being less than 500 nm; and

a sensing surface electrically coupled to the semiconductor element, the sensing surface comprising at least a first functional moiety that is capable of interacting with a first analyte of interest.

2. The nanosensor of claim 1, wherein the depth dimension of the semiconductor element is less than 200 nm.

3. The nanosensor of claim 1, wherein the depth dimension of the semiconductor element is less than 100 nm.

4. The nanosensor of claim 1, wherein the depth dimension of the semiconductor element is less than 50 nm.

5. The nanosensor of claim 1, wherein the depth dimension of the semiconductor element is less 25 nm.

6. The nanosensor of claim 1, wherein the depth dimension of the semiconductor is between about 15 nm and about 100 nm.

7. The nanosensor of claim 1, wherein the semiconductor element comprises silicon, and the insulator comprises silicon dioxide.

8. The nanosensor of claim 1, wherein the first functional moiety comprises a biochemical.

9. The nanosensor of claim 1, wherein the first functional moiety comprises a metal.

10. The nanosensor of claim 1, wherein the first functional moiety comprises a metal oxide.

11. The nanosensor of claim 8, wherein the first functional moiety comprises one member of: a receptor:ligand pair, a binding protein:ligand pair, an antibody:epitope pair, an antibody fragment:epitope pair, a pair of complementary oligonucleotides, or a phosphorylated protein:multivalent metal ion pair.

12. The nanosensor of claim 1, wherein the sensing surface comprises the first functional moiety coupled directly to a surface of the semiconductor element.

13. The nanosensor of claim 12, wherein the first functional moiety is directly coupled to the surface of the semiconductor element via a linker molecule.

14. The nanosensor of claim 1, wherein the sensing surface comprises the first functional moiety associated with a layer disposed over the semiconductor element.

15. The nanosensor of claim 14, wherein the layer disposed over the semiconductor element comprises an insulator layer.

16. The nanosensor of claim 14, wherein the layer disposed over the semiconductor element comprises a metal layer.

17. The nanosensor of claim 16, wherein the metal layer comprises a metal oxide layer.

18. The nanosensor of claim 16, wherein the metal layer is selected from gold, platinum, or tin.

19. The nanosensor of claim 1, wherein the semiconductor element comprises first and second segments, the first and second segments comprising different doping.

20. The nanosensor of claim 1, further comprising at least a first electrical circuit, electrically coupled to the semiconductor element.

21. The nanosensor of claim 20, wherein the at least first electrical circuit comprises a buffering circuit.

22. The nanosensor of claim 20, wherein the at least first electrical circuit comprises a multiplexing circuit, said multiplexing circuit being electrically coupled to at least one additional semiconductor element.

23. The nanosensor of claim 20, wherein the at least first electrical circuit comprises an amplification circuit.

24. The nanosensor of claim 23, wherein the additional semiconductor element is integral to an insulating substrate, has a length and width dimensions parallel to the insulating substrate, and a depth dimension orthogonal to the insulating substrate, the depth dimension being less than 100 nm, and a sensing surface electrically coupled to the semiconductor element, the sensing surface comprising a second functional moiety for interacting with a second analyte of interest.

25. The nanosensor of claim 24, wherein the second functional moiety is different from the first functional moiety.

26. The nanosensor of claim 1, further comprising first and second electrical contacts electrically coupled to different points along the length dimension of the semiconductor element.

27. A nanosensor, comprising:

a semiconductor element having a longitudinal axis, and attached to an insulating substrate such that the longitudinal axis is parallel to the insulating substrate, wherein the semiconductor element comprises a depth dimension orthogonal to the substrate that is less than 500 nm;

first and second electrical contacts in electrical communication with the semiconductor element at first and second different points along the longitudinal axis, respectively; and,

a sensing surface electrically coupled to the semiconductor element, having at least a first functional moiety immobilized thereon, wherein interaction of an analyte of interest with the functional moiety induces a change in an electrical property of the semiconductor element.

28. An array, comprising:

a first nanosensor element comprising a first semiconductor element integral to an insulating substrate, and having a length and width dimensions parallel to the insulating substrate, and a depth dimension orthogonal to the insulating substrate, the depth dimension being less than 500 nm, and a first sensing surface electrically coupled to the semiconductor element, the first sensing surface comprising at least a first functional moiety for interacting with a first analyte of interest; and,

at least a second nanosensor element comprising a second semiconductor element integral to an insulating substrate, and having a length and width dimensions parallel to the insulating substrate, and a depth dimension orthogonal to the insulating substrate, the depth dimension being less than 500 nm, and a sensing surface electrically coupled to the second semiconductor element, the second sensing surface comprising at least a second functional moiety for interacting with a second analyte of interest.

29. The array of claim 28, wherein the depth dimensions of the first and second semiconductor elements are less than 200 nm.

30. The array of claim 28, wherein the depth dimensions of the first and second semiconductor elements are less than 100 nm.

31. The array of claim 28, wherein the first and second nanosensor elements are independently electrically addressable.

32. The array of claim 28, wherein the first and second nanosensor elements are disposed in a single fluid reservoir.

33. The array of claim 28, wherein the first and second nanosensor elements are each electrically coupled to a multiplexing circuit.

34. The array of claim 28, wherein the first and second functional moieties are different.

35. The array of claim 28, wherein the first and second analytes of interest are different.

36. The array of claim 28, wherein the first and second analytes of interest are the same analyte.

37. The array of claim 28, wherein the first and second nanosensor elements are disposed in different fluid reservoirs.

38. The array of claim 28, wherein the first and second functional moieties are the same functional moiety.

39. A method of fabricating a nanosensor, comprising:

providing a semiconductor layer on an insulating substrate, wherein the semiconductor layer is less than 500 nm thick;

defining an elongated structure from the semiconductor layer, the structure having length and width dimensions that are parallel to the insulating substrate, and a depth dimension orthogonal to the insulating substrate that is less than 500 nm; and,

providing a sensing surface electrically coupled to the elongated structure, the sensing surface comprising a functional moiety that interacts with an analyte of interest to induce a change in an electrical property of the elongated structure.

40. The method of claim 39 wherein the step of providing a semiconductor layer on an insulating substrate comprises providing a semiconductor layer that is less than 200 nm thick.

41. The method of claim 39, wherein the step of providing a semiconductor layer on an insulating substrate comprises providing a semiconductor layer that is less than 100 nm thick.

42. The method of claim 39, wherein the depth dimension is substantially equal to the thickness.

43. The method of claim 39, wherein the semiconductor layer on an insulating substrate comprises a semiconductor on insulator substrate.

44. The method of claim 43, wherein the semiconductor on insulator substrate comprises a silicon on insulator (SOI) substrate.

45. The method of claim 44, wherein the SOI substrate comprises a silicon layer on a silicon dioxide layer.

46. The method of claim 43, wherein the semiconductor on an insulator substrate comprises a SiMOX wafer.

47. The method of claim 39, wherein the defining step comprises:

coating the semiconductor layer with a resist;

exposing and developing the resist to produce a pattern in the resist that corresponds to the structure to be defined;

protecting the pattern that corresponds to the structure to be defined; and,

removing the semiconductor layer that does not correspond to the structure to be defined, thereby defining the structure.

48. The method of claim 47, wherein the exposing step comprises irradiating defined portions of the resist with an electron beam.

49. The method of claim 47, wherein the exposing step comprises irradiating defined portions of the resist with light.

50. An analytical system, comprising:

a nanosensor, comprising:

a semiconductor element integral to an insulating substrate, and having a length and width dimensions parallel to the insulating substrate, and a depth dimension orthogonal to the insulating substrate, the depth dimension being less than 500 nm, and a ratio of the length dimension to the depth dimension being greater than 500;

a sensing surface electrically coupled to the semiconductor element, the sensing surface comprising a functional moiety capable of interacting with an analyte of interest; and,

a detector electrically coupled to the nanosensor for measuring conductance of the semiconductor element.

51. The system of claim 50, wherein the depth dimension of the semiconductor element is less than 200 nm.

52. The system of claim 50, wherein the depth dimension of the semiconductor element is less than 100 nm.

53. The system of claim 50, further comprising a fluid containing vessel, the sensing surface of the nanosensor being at least partially disposed within the fluid vessel.

54. The system of claim 53, wherein the fluid containing vessel comprises a fluidic conduit.

55. The system of claim 53, wherein the fluid containing vessel comprises a microfluidic channel.

56. The system of claim 53, wherein the fluid containing vessel comprises a well in a multiwell plate.

57. The system of claim 50, further comprising a computer operably coupled to the detector, the computer being operably programmed to receive and store conductance data from the detector.

58. The system of claim 50, further comprising a fluid handling system fluidly connected to the nanosensor for directing fluid samples into contact with the sensing surface of the nanosensor.

59. A method of analyzing a sample material, comprising:

providing a nanosensor comprising:

a semiconductor element integral to an insulating substrate, and having a length and width dimensions parallel to the insulating substrate, and a depth dimension orthogonal to the insulating substrate, the depth dimension being less than 500 nm;

a sensing surface electrically coupled to the semiconductor element, the sensing surface comprising a functional moiety capable of interacting with an analyte of interest; and,

contacting a sample material with the sensing surface of the nanosensor; and

determining a concentration of the analyte of interest in the sample material.

60. The method of claim 60, wherein the depth dimension of the semiconductor element is less than 200 nm.

61. The method of claim 60, wherein the depth dimension of the semiconductor element is less than 100 nm.

62. The method of claim 60, wherein the determining step comprises measuring a conductance of the semiconductor element, and correlating the conductance to a concentration of the analyte of interest.

63. The method of claim 60, wherein the contacting step comprises immersing the sensing surface in the sample material.

64. The method of claim 60, wherein the contacting step comprises flowing the sample material over the sensing surface.